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Science Olympiad

**Building Design Portfolio: Bottle Rockets**

**Components:**

Nose Cone:

The nose cone is one of the most critical parts of a bottle rocket. The nose cone tends to push the air out of the way so the rest of the rocket can follow. It minimizes the drag of the rocket when traveling through the air. But if you use a weak material the rocket will not be able to deflect the wind. The nose cones on the rockets for Science Olympiad have to be rounded or blunted according to the rules.

Passive Recovery System Back Sliders or gliders:

For backslider or glider rockets, they have to be designed carefully so that the center of gravity is in a specific position close to the center of pressure and lateral area. Most rockets like this are usually long and narrow, but for Science Olympiad it can only be a 1 liter bottle. The rocket works by instead of nose diving into the ground, they go up and come back down sideways or backwards.

Length of Body:  
  
The length of the body for the rocket has to be made out of a 1 liter bottle or less. The length of the body is also referred to as the pressure vessel. You are not allowed to use glue on the pressure vessel.

Fins:

The fins provide stability for the rockets. You don’t want the fins to heavy but you want them strong. There are many designs for fins, but the design you choose won’t affect your rocket greatly. The fins push against the air making the rocket fly straight up. Fin’s added to your rocket MUST be 5 cm or higher above the level of the bottles opening. But adding your fins as close to the opening of the bottle is suppose to help your rocket. Also the more stiff the fins the better.

Amount of Water:

The amount of water is simply the amount of water you put into the bottle. You are allowed to fill the bottle with any amount of water you want.

Type of Glue:

You are NOT allowed to use glue on any part of the pressure vessel. But if you are going to use glue on another part of it, you may want to use cement glue because it is very strong.

Center of Gravity:

The center of gravity is the average location of the weight of the object. If you balance the bottle rocket on your finger, the point of which it is balanced is the center of gravity.

**Materials:**

* 1 liter bottle
* Duct tape
* X-acto Knife
* Cardboard
* Dense Foam
* Pen/pencil
* Launcher

**Pros and Cons**

Glues:

Glue stick: won’t hold your rocket together. But it is very light and won’t add weight to the rocket.

Cement Glue: is very strong and will hold rocket together, but it is heavier

Conclusion: You should definitely use cement glue because a glue stick won’t hold your rocket together for more than 5 minutes. You would way rather have it a bit heavier than have your rocket fall apart.

Tapes:

Scotch Tape- Lighter, but won’t hold rocket together. Also it is not waterproof which would be a big issue in this event.

Duct Tape- Heavier, but will hold rocket together much better. Also this tape is waterproof.

Conclusion- You should use duct tape because even if it adds more weight it is stronger. Yet again you don’t want your rocket falling apart.

Fins:

Cardboard: Heavier, but more stiff.

Paper: Lighter, but not stiff.

Conclusion: You should use the cardboard because it is stiffer. The stiffer the paper is the better performance you will get.

**Design Plan**

Find a 1 liter bottle and clean it out. Make sure the nozzle diameter is 2.2 cm. Make your nose cone out of dense Styrofoam. Shape it the way you want making sure it is blunt or rounded. You can use the X-acto knife to shape it. To make sure the tip of the cone is right, take a 2 liter bottle cap and place it on top of the nose cone. Make sure the inside top of the cap is not touching the tip of the nose cone. Once you got the shape you like tape it on to the bottom of the bottle. Make sure it is very secure and doesn’t fall off. After that use the cardboard to cut out three fins. You can use any design that your heart desires, as long as the fins are still stable. Make sure that you leave flaps at the end so you can tape it to your bottle. Next you need to tape them to your bottle using the duct tape. After add some weight to your nose cone. Go find a nice place to launch your rocket. Make sure it is a clear field. Fill it with as much water you think is necessary. Then get your launcher and add 60 psi to the bottle rocket. Watch your rocket and record how long it stays in the air.

**Test Plan**

Launch your rocket and record your results. Do this multiple times. If the bottle rocket falls apart you will want to fix it as soon as possible to refrain from further damage. To get accurate results make sure you are putting exactly 60 psi in it. Also make sure you try different amounts of water to see which one works best for the rocket you built. Make sure you keep backup nose cones, fins, and other parts to the rocket incase it breaks or something goes wrong during launching.